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Probing the nature of Z_c states via the eta_c rho decay

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The nature of the so-called XYZ states is a long-standing problem. It has been suggested that such particles may be described as compact four-quark states or loosely bound meson molecules. In the present work we analyze the Z_c^(') -> eta_c rho decay using both approaches. Such channel might provide useful insights on the nature of the Z_c^('), helping discriminating between the two different models.

Summary

This work is based on arXiv:1409.3551 [hep-ph] plus some further developments.

We study the branching ratios for the decays of the Zc(3900) and Zc'(4020) into eta_c rho under both the assumptions of a compact 4-quark (tetraquark) and of a loosely bound meson molecule.
In the tetraquark picture we adopt the both the so-called type-I and type-II pictures (see Maiani et al. hep-ph/0412098 and 1412.2049[hep-ph]) and also with and without a model for the internal dynamics recently developed by Brodsky et al. (see 1406.7281).
For the molecular picture, instead, we employ the well-known Non-Relativistic Effective Field Theory (see e.g. 1301.6461 [hep-ph]).

Including proper theoretical errors, we compute the branching ratios for the decays into eta_c rho and show that, in almost all cases, the predictions of the tetraquark model and of the molecular one are different with a 2 sigma C.L. Therefore, this channel might provide a valuable insight to determine the nature of these resonances.

We also show that the molecular interpretation might be in contrast with the current data on the decays of Zc and Zc' into J/psi pi.

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